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ABSTRACT

Technological development and our human potential are two of the greatest challenges facing humankind today. The appropriate response to technological development seems to be to shape it for positive and productive human uses. Just as America once shifted from an agricultural economy to an industrial economy, we are now shifting from an industrial economy to an information processing economy. The primary technologies which will deeply influence this post-industrial society are advanced computer technologies, telecommunications, robotics, and biotechnology. These technological developments will cause a considerable shift in jobs by creating a demand for specialized technicians and decreasing the demand for unskilled labor. As we progress technologically, personal adjustment problems become more prevalent. Whenever new technology is introduced into society, there needs to be a counterbalancing human response; counselors and other helping professionals will be sought for their assistance in this response. There are three significant areas of constructive coping: the emotional level, the physiological level, and the behavioral level. By discovering our potential as human beings through taking charge of our own lives, through achieving balance in our lives, and through constructive coping, we participate in the evolution of the human race and develop the inner knowledge required to guide our exploration of technology. (NRB)

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THE HUMAN RESPONSE TO TECHNOLOGICAL DEVELOPMENT

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THE HUMAN RESPONSE TO TECHNOLOGICAL DEVELOPMENT

Technological development and our human potential are two of the greatest challenges and adventures facing humankind today. Many of the problems of advanced technology are human problems--problems which cause us to search our personal and societal values and changes which require our constant adaptation. The economic factors inherent in the United States being a capitalistic society and continuing as a world power move technological development onward. Therefore, we cannot stop that development. Instead, the appropriate response to technological development seems to be to shape it for positive and productive human uses.

This article will provide an overview of current technological trends and probable ways in which these trends will impact our society. A discussion of the human response to technological development will follow. That discussion will include strategies that both counselors and human resource personnel can implement at both individual and institutional levels.

Trends in Technological Development

The American society of the 1980's is quickly becoming a "post-industrial society" -- a society whose economic base is no longer dominated by the economics of its manufacturing sector. Just as this nation once shifted from an agricultural economy to an industrial economy, we have been shifting from an industrial economy to an information processing economy (Bell, 1973). In the past 25 years the greatest increase in new jobs has been in information workers. Information workers are those who create, process, analyze, and distribute information. Included in this category are such jobs as computer programmers, systems analysts, engineers, librarians, newspaper reporters, secretaries, clerks, teachers, accountants, stock brokers, managers, insurance workers, lawyers, bankers, and bureaucrats, to name only a few. In 1950 17% of the work force were information workers. By 1980 that figure had increased to 65% of the work force and the percentage continues to increase (Naisbitt, 1982). *Megatrends* points out that a short history of labor in the United States takes us from the farmer to the laborer in industry to clerks and now to technicians. Thus, by "post-industrial society" we mean a society whose economy is

dominated by information processing and the creation of knowledge. The post-industrial society is an information society.

The primary technologies which will deeply influence this post-industrial society are advanced computer technologies, telecommunications, robotics, and biotechnology. Each of these technologies contributes to the pervasiveness of information processing.

There are many tangible examples of advanced computer technologies and telecommunications:

* Communications satellites which provide instant and inexpensive worldwide communication via telepone.
* Microelectronics which allow minature electronics to enhance our cognitive abilities to process information, to educate ourselves, and of course, to entertain ourselves.
* Photocopying.

These technologies are continuing their fast pace of development so that very soon we'll see:

* Cellular phone systems that would enable us to take a phone with us wherever we go.
* The broad application of "fourth generation" computing technology -- that is, very large scale integrated circuits putting "user friendly" intelligence into almost every appliance or system we use. This would mean that all of us could use computer functions without knowing how they work -- just as we now can use television, radio, and telephones without understanding them conceptually. Products with these characteristics would include automobiles, consumer electronics, house appliances and home management systems that could do such things as remind you of maintenance and manage your home energy supply.

This rapid pace of development is likely to continue because the Japanese have made development of even more advanced computer technologies --a "fifth generation" computer technology -- a national priority (Feigenbaum & McCorduck, 1983). What this means to our nation is that in order to remain an economic world power, the United States will have to successfully compete with the Japanese in the world markets in this area of technological development.

The Japanese fifth generation computing project is a project to develop

computers that can simulate vision, hearing, speaking, and to an extent, thinking. "Seeing" refers to the ability to interpret scenes sensed by television cameras. "Hearing" and "speaking" refer to the ability to perform a degree of natural language processing, that is, to be able to interpret human speech as it is spoken in a language such as Japanese or English and be able to respond in that language. "Thinking" refers to the ability to process information and to make decisions in a manner similar to humans -- an analytic function. These computer functions together are referred to as "artificial intelligence" (AI).

The Japanese are developing artificial intelligence because they see it as essential to their to their national economic well-being:

* They can't compete with the low labor cost of the new industrial powers such as South Korea, Brazil, and Singapore, so they feel they must become dominant in information processing.
* Their population is aging very rapidly and they see these new computers as necessary in order to economically support their elderly population.

A third technology, robotics, is also contributing to the information age. Robotic technology, which is defined as the technology which automates tasks whose complexity previously could only be performed by humans, will have less impact globally than computer or telecommunication technology. Robotics will stay in the factory and the office where tasks are constrained by the environment. Manipulator arms and robots won't be seen outdoors or in the home that much.

There are two primary reasons for the use of robots rather than humans:

* Robots can be used in environments that cause fatigue or health hazards to humans, such as very hot environments or environments where there are chemical toxins.
* Robots reduce labor costs.

By and large, foreign labor is less expensive. This is resulting in many American companies exporting their jobs by moving their plants to other countries. Many companies who want to keep their plants in the United States will use robots to reduce labor costs. A quality robot that costs approximately $50,000 can work 16 hours a day for eight years. It costs about $5.00/ hour as opposed to $15.00/hour for a Japanese auto worker or $20.00/hour for an American auto worker (Naisbitt, 1982). Robotic technology is different from traditional automation in that it has inherent flexibility because it can be reprogrammed as necessary to perform new work. This

would enable small companies to use robotic factories to produce goods catering to small market segments. Or a single auto assembly plant could be converted to producing specialty vehicles by reprogramming a computer-controlled robotic assembly process.

These technological developments will cause a considerable shift in jobs. They are creating an incredible demand for high-paid and specialized technicians -- those who can design, program, and use these technologies and those who know how to repair them when they break down. The United States will need a million or more computer programmers by the end of the decade (Naisbitt, 1982). Unskilled jobs, however, are being replaced, and new service jobs (such as in the fast food industry) which can employ these unskilled workers, are not paying a wage nearly as high as the assembly line. This shift in jobs has strong implications for career counseling and training and development, as well as for society at large.

The fourth technology that will have a great impact on our society is biotechnology. Biotechnology includes such activities as fermentation technology to make drugs and chemicals, the production of enzymes or "living catalysts", and gene splicing. The next twenty years could become as dominated by biotechnology as the last twenty years have been dominated by microelectronics. Biotechnology could allow scientists to address energy resource problems by the development of a biodigestor to produce alcohol. It could provide an inexpensive way to synthesize previous scarce natural resources, such as insulin. It could revolutionize agriculture with new high-yield, disease-resistant, self- fertilizing crops (Naisbitt, 1982). If used for the betterment of humankind, these technologies could enable us to build a more prosperous society that is more self-sustaining and more able to help others. The development and use of biotechnologies, as all other technologies, will require guidance by the higher values of humankind that will direct these technologies toward the betterment of the world community rather than only the superiority of American technology.

The Paradox of Progress

Technological progress brings a paradox. As we progress technologically, more is demanded of us in terms of psychological adjustment. Personal adjustment problems are more prevalent today than ever. Symptoms of our collective distress

can be found in statistics of drug dependency, stress-related illnesses, divorce, spouse and child abuse, job dissatisfaction, suicide, insomnia, sexual dysfunction, criminal behavior, and countless other statistics.

Erich Fromm offers us a historical perspective. Fromm points out that in our modern society we are faced with far more decisions about how to lead our lives. We have more economic freedom that leads us on a quest for meaningful work. We have geographic freedom to stay in our home town or move away. We have political freedom that demands a decision about how active we will be in our political process. We have religious freedom and the freedom to choose our own values. We have a multitude of daily choices to make. Each time we walk into a grocery store, we must choose betweeen five brands of butter, 20 brands of laundry soap, and 50 brands of cereal. And while being confronted with far more decisions, our old sources of emotional security have diminished in effectiveness. Many find the new freedom scary and threatening. The progress we value so much has undermined our sense of security, scrambled our value systems, and confronted us with new and different adjustment problems. Fromm does not believe that progress is inherently bad or undesirable. He simply feels that it is important to understand the nature of the challenge we face in modern times (Fromm, 1941).

Alvin Toffler coined the term "future shock" and defined it as the disorientation experienced by people who are overwhelmed by rapid and excessive social change. Toffler describes the inability of many people to cope with this avalanche of change. He argues that many of our social problems can be attributed to the whirlpool of change that engulfs us. Change often brings feelings of restlessness, anxiety, and uncertainty. The basic challenge of life becomes a search for a sense of direction (Toffler, 1970).

The Effective Human Response

If all this is true, what do we do? The key to effective personal adjustment is taking charge of one's own life, creating balance in one's own life, and learning to cope with stress effectively. The essense of taking charge of own's own life is what nearly all theorists of psychotherapy have emphasized -- the acceptance of self-responsibility. This is the realization that I, and no one else, am responsible for

my life choices; that there will be no knight in shining armor or no nurturing wife who can take over this sometimes painful responsibility. By taking charge of our own lives and by discovering our potential as human beings we participate in the evolution of the human race. We develop the inner knowledge and wisdom to guide our exploration of technology.

Creating Balance

Whenever new technology is introduced into society, there needs to be a counterbalancing human response. Naisbitt in *Megatrends* calls this concept "High tech/ High touch." He urges us to learn to balance the material wonders of technology with the spiritual demands of our human nature. The efficiency of automatic banking does nothing to fulfill or eliminate one's need for human interaction. And having your own home computer will not eliminate the need for contact and communication with your colleagues. We will have a greater need to compensate for technology by being with people, by being out in nature more often, going camping, to the beach, or to the mountains. In a high-tech world, where we use our brainpower instead of performing physical labor, we will need to use our hands and bodies more in our leisure activities to balance the constant use of mental energy at work. The more high technology around us, the more the need for human touch.

What is needed is a well-developed life -- one that balances work, play, and life-long learning (Bolles, 1978). In a high-tech world, people will need to do more with their families and develop activities that give them pleasure. Also very important will be activities in which they give their time and energy to others, preferably with no compensation. Many will need outlets for values that aren't supported by work and will need to experience the pleasure of developing the inner life -- moral courage, acting according to principles, and loving and giving to others.

On an institutional level, whenever institutions introduce new technology to customers or employees, they should build in a high-touch component; if they don't, people will try to create their own or may reject the new technology. "User friendly" is a term used in the computer business to describe the quality of interface between the computer and the person. Computers which are more "user friendly" have more appeal to new users of computers. The more high-tech in our society, the more we will want to create a high-touch environment, with soft edges balancing the hard

edges of technology. For example, the "country look" is becoming popular in home furnishings -- antiques, earth colors, wood, cloth, and the look of nature indoors are replacing some of the earlier interest in chrome and acrylic furnishings.

Constructive Coping

There are three significant areas of constructive coping: the emotional level, the physiological level, and the behavioral level (Weiten, 1983). Constructive coping at the emotional level would involve such things as:

* having a support system that is nurturing. Where families used to provide a natural support system, relocation now seems to be the norm, and that necessitates developing a support system outside of one's family.
* releasing pent-up emotions through talking out frustrations, allowing oneself to cry, journal writing, exercising, and various other healthy approaches that release anger, guilt, and frustration.
* learning to short-circuit emotional reactions through changing irrational thoughts and replacing them with positive thinking.

Constructive coping at the physiological level would involve the following:

* good nutrition
* adequate sleep
* regular exercise, which needs to be a mind-quieting relaxation such as meditation or employing Benson's (1975) relaxation response -- not merely watching television or being with friends. Those activities, even when positive, can also be stressful (Forbes, 1979).

Constructive coping at the behavioral level involves understanding and utilizing systematic problem solving methods that address the specific problems that are producing stress in one's life. This involves learning to clarify one's problems, generating alternative courses of action, assessing and choosing alternatives, and taking action. These problem solving processes are described by such writers as Mahoney (1979) and Miller (1978). Egan's (1982) approach to helping others also has application to helping oneself.

A Challenge to Professionals

Counselors and other helping professionals will be sought for their assistance

in dealing with the personal adjustment problems that seem more prevalent and more prominent than ever. Employee assistance programs are bound to increase. Career counseling will be needed by a majority of the working population. The training and retraining of the American work force that will be needed to keep pace with technological development will be massive. The new illiteracy will be computer illiteracy. The adaptation required of individuals, especially those reaching middle age and older, will continue to be enormous.

High tech/High touch. The principle symbolizes the need for balance between our physical and our spiritual realities. By discovering our potential as human beings through taking charge of our own lives, through achieving balance in our lives, and through constructively coping, we participate in the evolution of the human race. We develop the inner knowledge and wisdom required to guide our exploration of technology.

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